

10-0000 SEWAGE AND SOLID WASTE DISPOSAL

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10-0100 SANITARY SEWER DESIGN CRITERIA

10-0101 Applicability. Sanitary sewer facilities, approved by the appropriate County agencies, shall be provided for subdivision lots of less than 20,000 ft² (1858 m²) in size.

10-0102 General and Hydraulic

10-0102.1 Type of Sewers. The County integrated sewerage system is designed to provide total containment. No new systems, extensions, or replacements, not designed to provide total containment for the design period, shall be approved or permitted.

10-0102.2 Compliance with Design Criteria. These criteria are to establish minimum requirements as a basis for expeditious review under the County's local plan review program in order for DPWES to comply with its Virginia NPDES Permits and requirements imposed by the DEQ/VDH Manual of Practice for Sewerage Systems.

10-0102.3 Tributary Population

10-0102.3A Sewerage facilities shall be designed for the estimated ultimate tributary population. Consideration shall be given to the adopted Comprehensive Plan and to the maximum anticipated capacity of uses such as, but not limited to, institutions, industrial parks and apartment developments.

10-0102.3B Trunk and subtrunk sewers shall be designed on the basis of the adopted Comprehensive Plan densities and/or zoning, whichever is greater, unless the Board approves otherwise. Design analysis shall be provided for all trunk and subtrunk sewers and when required by DPWES, Office of Waste Management, for collecting sewers.

10-0102.3C Facilities designed to serve populations of 14,000 or greater or which include pumping stations, force mains or inverted siphons, shall be subjected to the public hearing process under § 15.1-453 and § 15.1-456 of the Va. Code, as amended, and compliance with Section 2.00 of the DEQ/VDH Manual of Practice for Sewerage Systems.

10-0102.4 Sewage Flow:

10-0102.4A Recommended Average Design Flows:

TABLE 10.1 AVERAGE DESIGN FLOWS FOR DEVELOPMENT TYPES

<u>Type of Development</u>	<u>Design Flow GPD (LPD)</u>
Residential:	
general	100/person (380/person)
single family	370/residence (1400/residence)
townhouse unit	300/unit (1140/unit)
apartment unit	300/unit (1140/unit)
Commercial:	
general	2000/acre (18700/ha)
motel	130/unit (490/unit)
office	30/employee (110/employee) .20/net ft ² (8/net m ²)
Industrial:	
general	10,000/acre (93500/ha)
warehouse	600/acre (5600/ha)
varies with type of industry	
School Site:	
general	16/student (60/student)

10-0102.4B Sewers shall be designed to carry a peak flow when full as determined from applying the appropriate peak flow factor to the average flow. (See Plates 1-10 (1M-10) and 2-10 (2M-10).) No separate allowance for infiltration will be required.

10-0102.5 Location of Sewers and Manholes

10-0102.5A In general, sewers shall be located on legally established streets or rights-of-way, on the centerline of the street or within 8' (2.4m) of the centerline; and shall be equidistant from property lines or curb lines wherever possible.

10-0102.5A(1) (59-97-PFM) In order to reduce the number of manholes in curvilinear streets, manholes must be located within the pavement area but beyond the allowable spread of stormwater gutter flow except where reverse curb and gutter is used, and a minimum of 6' (1.8m) of clear separation from edge to edge between the sanitary sewer manholes and water, storm and gas pipes must be provided.

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10-0102.5A(2) The sanitary sewer pipe may be located anywhere within 5' (1.5m) of the right-of-way line.

10-0102.5A(3) (60-97-PFM) Sanitary sewer pipe and manholes may be located within the paved portion of privately owned and maintained pipestem driveways when it has been demonstrated that such location will result in a substantial saving of trees. This provision does not preclude the crossing of pipestem driveways at generally 90° with a sanitary sewer pipe.

10-0102.5A(4) The horizontal and vertical separation between sewers and waterlines shall be in accordance with the requirements of Section 12.05 of the Commonwealth of Virginia Waterworks Regulations.

10-0102.5A(5) (45-94-PFM) The minimum horizontal separation required for storm sewer and sanitary sewer lines and their respective structures ("the sewer facilities") shall be 6' (1.8m) between the nearest exterior surface of each pipe, with the exception of the convergence and intersection of sewer facilities which must cross one another. When crossing, the minimum vertical separation between the sewer facilities shall be as follows: When storm sewer lines are above sanitary sewer lines, there shall be a minimum of 2' (600 mm) separation between the sewer facilities unless the storm sewer line is encased in steel and/or concrete piers are installed which extend through any fill areas and into original ground. When sanitary sewer lines are above storm sewer lines, there shall be a minimum of 18" (450mm) separation between the sewer facilities unless the sanitary sewer line is encased in steel and/or concrete piers are installed which extend through any fill areas and into original ground.

10-0102.5A(6) (52-96-PFM) Design of sanitary sewer lines shall honor natural drainage patterns or topography and shall be of sufficient depth to provide gravity flow to serve the basement/lowest floor of dwellings and buildings. Manhole depths shall not exceed 16' (4.8m) without approval of the Director. When extenuating circumstances are thought to exist by the applicant to allow manhole depths greater than 16' (4.8m), such as crossing under natural or man-made features (e.g., highways, railroads or bodies of water) or making connections to proposed or existing

systems in which the applicant considers good engineering practice to dictate a modification of this standard, specific approval must first be obtained from the Director. In considering such a modification request, the Director may consider safety concerns, maintenance considerations, soil conditions, construction material to be used, and the availability of other feasible alternatives.

10-0102.5A(7) (52-96-PFM) The installation of PVC and reinforced concrete pipe shall not be permitted at depths exceeding 18' (5.5m). Ductile iron pipe shall be required where sewer depths exceed 18' (5.5m) and shall be installed from manhole to manhole.

10-0102.5B (31-90-PFM) Sanitary sewer service shall be provided to the satisfaction of the Director such that the main shall be extended to the nearest property line of the last lot to be served and easements extended to a property line where adjoining areas must be served.

10-0102.5C Generally, proposed sanitary sewers shall not be located closer than 15' (4.6m) from existing or proposed buildings.

10-0102.5D Manholes for access to sewers shall be provided:

10-0102.5D(1) At all intersections of sewers that are 27" (675mm) in diameter or smaller; and

10-0102.5D(2) At all points of change in alignment; and

10-0102.5D(3) At all changes in grade; and

10-0102.5D(4) At points of industrial discharge if required by DPWES to facilitate observation and sampling; and

10-0102.5D(5) Within 10' (3m) (centerline to centerline) of any connection to a 30" (750mm) diameter sewer or larger; and

10-0102.5D(6) At the terminal of the line; and

10-0102.5D(7) At intervals not exceeding 400' (120m) on all sewers 15" (375mm) in diameter or less and not exceeding 500' (150m) apart on all

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sewers larger than 15" (375mm) in diameter (see Plates 3-10 (3M-10) thru 14-10 (14M-10)).

10-0102.5E (100-07-PFM) (41-94-PFM) When it is necessary to drop the elevation of the sewer at a manhole due to unusual circumstances such as bad soil, rock, high water table, utility conflicts or excessive depths, an inside drop connection is required. (See Plate 15-10 (15M-10)). Any drop connection for a sewer line diameter of 15" (375mm) or greater shall require a special design to be approved by DPWES. The maximum difference in elevation permitted between the influent and effluent lines in a standard manhole will be 6" (150mm).

10-0102.5E(1) Typical 4' (1200mm) Manhole with Inside Drop Connection – Special Notes:

10-0102.5E(1)(a) Chamfer on all pipe sizes to be at a 15° angle.

10-0102.5E(1)(b) (32-90-PFM) Vertical stacks 10" (250mm) and larger in diameter will require a minimum 5' (1500mm) diameter manhole.

10-0102.5E(1)(c) Vertical stack to be SDR 40 PVC pipe connected to drop fitting with standard coupling and solvent weld.

10-0102.5E(1)(d) Vertical stack will be strapped to manhole at the joint when more than 1 section of pipe is used. Strap to be made of material noncorrosive to sewer gases.

10-0102.5E(1)(e) Elbow at bottom of the stack will be either a 45° or 90° turn made of SDR 40 PVC pipe placed in the direction of the flow in manhole, with bench constructed to conform to manhole bench.

10-0102.5E(1)(f) (32-90-PFM) When pipe material is other than PVC, a full circle clamp coupling will be used at the intersection of the incoming main to the PVC inside drop fitting. This coupling shall be tested in accordance with § 10-0105. The length of this coupling shall not be less than the size of the nominal pipe diameter of which it is being used on, e.g., 8" (200mm) diameter pipe requires a coupling no less than 8" (200mm) in length.

10-0102.5F Sewer manholes for sewers up to 21" (525mm) in diameter shall not be less than 4'

(1200mm) inside diameter. Manholes for sewers 24" (600mm) and up to 36" (900mm) shall have an inside diameter of not less than 5' (1500mm). If the angle of deflection does not permit use of a 5' (1500mm) inside diameter manhole, then a special manhole detail must be shown.

10-0102.5G (39-93-PFM) Line connections to existing manholes shall be made by coring the manhole wall. No more than 4 openings shall be allowed in 1 manhole. The distance between openings on the inside wall of the manhole shall not be less than 6" (150mm) between the outside edge of 1 opening to the outside edge of another opening. Pipe, 10" (250mm) or less in diameter, shall be connected to the manhole by an approved flexible connector. Pipe, 12" (300mm) or more in diameter, may connect to the manhole wall with a short length of pipe with a joint within 2' (600mm) of the inside face of the manhole wall. Where the pipe bell is in conflict with the manhole footing, the length of pipe may exceed 2' (600mm) in order to clear the edge of the footing.

10-0102.5H When designing new sewers to tie into existing manholes, the bench elevation at the inside manhole wall shall be stated on plans, so that the invert of the new tie-in is not established lower than the existing bench. When the existing sewer line is larger than the new connection, the crown of the new pipe shall be no lower than the highest crown of the existing line within the manhole. Where grade does not permit, approval shall be obtained from the Director at the time of first submission.

10-0102.5I All sanitary sewer manholes or appurtenances subject to infiltration of surface water must be provided with a County standard watertight manhole frame and cover, which shall be shown on the plans. Should actual field conditions require it, however, alterations may be permitted.

10-0102.5J Ventilation of gravity sewers shall be provided where continuous watertight sections greater than 1000' (300m) in length are incurred.

10-0102.5K Provisions for flow measurement (flume installations) will be provided at major junctions in the collection system where designated by DPWES, Office of Waste Management (i.e., generally at the 2 MGD (7.5 MLD) collection points).

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10-0102.5L (59-97-PFM) Sewers adjacent to or crossing streams, estuaries, lakes and reservoirs shall be designed, constructed and protected in accordance with requirements of Section 3.8 of the VDH Sewerage Regulations, except that:

10-0102.5L(1) (59-97-PFM) Sewer lines that cross a well defined watercourse with bed and banks shall be located under the watercourse and shall be ductile iron pipe CL-52 with mechanical joints extending from manhole to manhole. If less than 3' (0.9m) of suitable cover is provided between the watercourse invert and the top of the sanitary sewer line, then a special design will be required to protect the section of the pipe under the watercourse from exposure due to future erosion. The special design shall consist of tunnel liner extending a minimum distance of 5' (1.5m) into the stream banks on either side of the watercourse and stabilization of the watercourse with riprap or equivalent channel lining as approved by the Director to prevent erosion to the bottom of the watercourse.

10-0102.5L(2) (45-94-PFM) Sewer lines should not be located within a detention area. However, if sewer lines must be placed in a detention area, the lines shall only be permitted in a dry detention area with a minimum cover of 4' (1200mm) and shall be ductile iron.

10-0102.5M (41-94-PFM) For sanitary lines constructed in fill areas, pipe shall be ductile iron CL-52 and must run continuous from manhole to manhole (i.e., no adaptor). Manholes in fill areas shall be subject to special design provisions by the design engineer, shall extend into the original ground, and be filled with Class A-3 (20) concrete to the invert elevation except in cases where a special design is approved by the Director.

10-0102.6 (30-90-PFM) Minimum Sewer Size. Minimum pipe diameter for public gravity sanitary sewers shall be 8" (200mm).

10-0102.7 Acceptance Tests. Acceptance tests shall be required for all gravity sanitary sewer lines and manholes. The test may be either a water test, air test, or vacuum test. Consult § 10-0105 for additional details.

10-0102.8 Hydraulic Design Criteria. The hydraulic design and determination of sewer size shall be based on the following conditions:

10-0102.8A (45-94-PFM) Sewers shall have a uniform slope and straight alignment between manholes and the interior downstream angles formed by consecutive manhole sections shall not be less than 90°.

10-0102.8B At all junctions where a smaller diameter discharges into a larger one and at all locations where the sewer increases in size, the invert of the larger sewer shall be lowered so that the energy gradients of sewers at junction are at the same level. Generally, this condition will be met by placing the 0.8 depth of flow in each sewer at the same elevation.

10-0102.8C Sewers shall be designed to be free flowing with the hydraulic grade below the crown and with hydraulic slopes sufficient to provide an average velocity of not less than 2.25 FPS (0.7 MPS) when running full. Computations of velocity of flow shall be based on a coefficient of roughness "n" in the Manning Formula of 0.013.

10-0102.8D (35-91-PFM) For sewage flow depth less than 1/4 full, no allowance shall be made for increased value of "n" and in no case shall velocities of less than 1.3 FPS (0.4 MPS) be permitted. The improved velocities shall be accomplished by steeper grades. In no case shall a terminal manhole section be less than 1.0% grade.

10-0102.8E The maximum permissible velocity at average flow (before applying peak flow factor) shall not exceed 15 FPS (4.6 MPS).

10-0102.8F Suitable drop manholes shall be provided to break steep slopes to limit the velocities in the connecting sewer pipes between manholes. Where drop manholes are impractical for reduction of velocity, the sewer shall be of ductile iron or other abrasion resistant material.

10-0102.8G (35-91-PFM) In general, the following are minimum grades to be provided for pipes flowing at full depth to 1/2 of full depth:

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TABLE 10.2
MINIMUM GRADES (%) FOR PIPES

Sewer Size in. (mm)	Pipe Lengths Up to 5' (1.5m)	Pipe Lengths 6' (1.8m) or More
Terminal Section*	1.0	1.0
8 (200)	0.47	0.42
10 (250)	0.34	0.31
12 (300)	0.26	0.24
14 (350)	0.23	0.22
15 (375)	0.18	0.17
16 (400)	0.17	0.16
18 (450)	0.14	0.13
21 (525)	0.11	0.11
24 (600)	0.08	0.088
27 (675)	0.08	0.08
30 (750)	0.07	0.07
33 (825)	0.06	0.061
36 (900)	0.05	0.056
39 (975)	0.05	0.05
42 (1050)	0.04	0.045

* 35-91-PFM

10-0102.8H Invert channels in terminal manholes shall be built at a grade of not less than 8.33%.

10-0102.8I At transitions and intersections of sewers larger than 21" (525mm) in diameter, each case shall be investigated separately.

10-0102.8J In general the pipe diameter of subtrunk sewers shall increase continually with the increase in tributary flow. Where steep ground slopes make possible the use of a reduced pipe size and a substantial economy of construction cost can be derived, the pipe size may be reduced, but due hydraulic allowances shall be made for head loss of entry, increased velocity and the effect of velocity retardation at the lower end where the flow will be on a flatter slope. In no case shall pipe sizes be reduced below 12" (300mm) in diameter.

10-0102.9 Sanitary Sewer Pump Systems for Individual Dwellings.

10-0102.9A Private sanitary sewer pump systems for individual dwellings may be permitted if sewer

service is not available by gravity flow subject to the following:

10-0102.9A(1) There shall be a maximum of 1 dwelling unit per line/lateral;

10-0102.9A(2) The velocity shall be a minimum of 2 FPS (0.6 MPS).

10-0102.9A(3) Where the pump is proposed to be located outside the proposed structure, a low-head grinder pump shall be provided where the projected flow is less than 2000 GPD (7571 LPD).

10-0102.9A(4) Where the pump is proposed to be located within the structure, an ejector pump may be used;

10-0102.9A(5) Either pump system under § 10-0102.9A(3) and § 10-0102.9A(4) shall be provided with a holding tank and an alarm system.

10-0102.9B For properties which in the opinion of the developer, builder and the owner, are not able to be sewered by gravity flow, a plan shall be submitted to the Office of Site Development Services, DPWES, showing the public sanitary sewer system, the sewer profile, the proposed pumping equipment and the required easement. All easements must be recorded before building permits may be issued.

10-0102.9C All plats, plans, profiles and documents submitted to the County for approval must show the following notes when a private sanitary sewer pump facility is proposed:

10-0102.9C(1) The sanitary lateral pipe and pump is a private system and the ownership of same shall be vested in the owner of the premises on which the system or portions thereof, are located.

10-0102.9C(2) The County is not responsible for operation or maintenance of the private sanitary sewer pump system.

10-0102.9D Private sanitary sewer pump facilities may not be located in an unapproved sewer service area unless approved by the Board.

10-0102.9E The connection of a private sanitary sewer pump facility to the County sewer system shall

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be made by a 4" (100mm) gravity flow line (one 4' (1.2m) section of pipe) at a minimum grade of 1%.

10-0102.10 Current specifications for the construction of sanitary sewer systems are available from DPWES, Office of Waste Management.

10-0102.11 (59-97-PFM, 77-02-PFM) Abandonment and Removal of Existing Sewer.

10-0102.11A (59-97-PFM, 77-02-PFM) An existing sanitary sewer line shall not be abandoned or removed until a new line has been installed, has passed the acceptance tests, and the sewer flow has been diverted from the existing line to the new line.

10-0102.11B (59-97-PFM, 77-02-PFM) The Wastewater Collection Division of the Fairfax County Department of Public Works and Environmental Services shall be notified not less than 24 hours before the sanitary sewer flow is diverted to the new line.

10-0102.11C (59-97-PFM, 77-02-PFM) The sanitary sewer easement serving the sewer line to be abandoned or removed shall be vacated prior to bond release and after the sewer flow has been diverted to the new line and the easement associated with such new line has been duly recorded among the land records.

10-0102.11D (59-97-PFM, 77-02-PFM) The Director may approve the abandonment in place of unused sanitary sewer lines and manholes. Sanitary sewer lines and manholes to be abandoned in place in lieu of being removed shall be treated as follows:

10-0102.11D(1) (59-97-PFM, 77-02-PFM) All sewer lines must be filled with grout and the ends plugged with masonry.

10-0102.11D(2) (59-97-PFM, 77-02-PFM) Sewer manholes must have the cone section removed and be filled to grade with acceptable compacted material.

10-0102.11D(3) (59-97-PFM, 77-02-PFM) At the time of vacation of the easement, fee simple title ownership of the abandoned sanitary sewer structures shall be conveyed to the property owner on whose real property such sanitary sewer lines and manholes are located and such property owner shall assume, and shall indemnify the County for all liability and

responsibilities therefore and such conveyance and assumption shall be duly recorded among the land records.

10-0103 Structural

10-0103.1 General. The structural design of sewers shall conform with the methods given in the ASCE Manual No. 37 for the Design and Construction of Sanitary and Storm Sewers except as modified hereinafter.

10-0103.2 Working Strength. The working strength for rigid pipes shall be the minimum ultimate 3-edge bearing strength divided by a factor of safety of 1.5.

10-0103.3 Allowable Load. The allowable load shall be the working strength times the load factor shown below:

**TABLE 10.3 ALLOWABLE LOAD FACTOR
FOR CLASS B BEDDING (39-93-PFM)**

<u>Type Bedding</u>	<u>Load Factor</u>
Class B	1.9

10-0103.4 Backfill load. Unless more specific data is available, the backfill load shall be computed using the following values:

Backfill weight: $w = 130 \text{ lb/ft}^3$ ($w = 2082 \text{ kg/m}^3$) for $k_u = 0.13$

10-0103.5 Live load. Sewers in public streets shall be designed for an HS-20 truck loading as specified by AASHTO for up to 10' (3m) of cover. Concentrated Load: 16,000 lb (7257 Kg), (single dual wheel). Impact Factor: $I = 1.3$, 0 to 1' (0 to 0.3m); $I = 1.2$, 1' to 2' (0.3 to 0.6m); $I = 1.1$, 2' to 3' (0.6 to 0.9m).

Length of Pipe: L = length of distributed load area at top of pipe parallel to longitudinal axis of pipe.

10-0103.6 Trench width. The width of trench at or below the top of the pipe shall not exceed the widths as shown in Table 10.4:

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**TABLE 10.4 TRENCH WIDTH REQUIRED
FOR PIPE SIZE**

Diameter of Sewer in. (mm)	Trench Width in. (mm)
8 - 16 (200 - 400)	42 (1050)
18 & 20 (450 & 500)	44 (1100)
21 (525)	48 (1200)
24 (600)	51 (1275)
27 (675)	55 (1375)
30 (750)	60 (1500)
33 (825)	63 (1575)
36 (900)	69 (1725)
42 (1050)	78 (1950)
48 (1200)	87 (2175)
54 (1350)	96 (2400)

10-0103.7 Maximum permissible depth. The maximum permissible depth of cover for sewer pipes of various classifications allowed shall be determined by Table 10.5 (See Plates 18-10 (18M-10) thru 20-10 (20M-10)).

**TABLE 10.5 MAXIMUM ALLOWABLE DEPTH TO
PIPE WITHOUT CRADLE (CLASS B BEDDING) (52-96-PFM)**

PIPE DIAMETER in. (mm)	MAXIMUM TRENCH WIDTH in. (mm)	CONCRETE	REINFORCED CONCRETE			PVC
		C-14 EXTRA ft (m)	C-76 CLASS III ft (m)	C-76 CLASS IV ft (m)	C-76 CLASS V ft (m)	SDR 35 ft (m)
8 (200)	42 (1050)	16 (4.9)	-	-	-	18 (5.5)
10 (250)	42 (1050)	13 (4.0)	-	-	-	18 (5.5)
12 (300)	42 (1050)	-	11 (3.3)	15 (4.6)	18 (5.5)	18 (5.5)
14 (350)	42 (1050)	-	-	-	-	-
15 (375)	42 (1050)	-	11 (3.3)	18 (5.5)	18 (5.5)	18 (5.5)
16 (400)	42 (1050)	-	-	-	-	-
18 (450)	44 (1100)	-	12 (3.6)	18 (5.5)	18 (5.5)	-
20 (500)	44 (1100)	-	-	-	-	-
21 (525)	48 (1200)	-	13 (4)	18 (5.5)	18 (5.5)	-
24 (600)	51 (1275)	-	14 (4.3)	18 (5.5)	18 (5.5)	-
27 (675)	55 (1375)	-	15 (4.6)	18 (5.5)	18 (5.5)	-
30 (750)	60 (1500)	-	15 (4.6)	18 (5.5)	18 (5.5)	-
33 (825)	63 (1575)	-	15 (4.6)	18 (5.5)	18 (5.5)	-
36 (900)	69 (1725)	-	15 (4.6)	18 (5.5)	18 (5.5)	-
42 (1050)	78 (1950)	-	15 (4.6)	18 (5.5)	18 (5.5)	-
48 (1200)	87 (2175)	-	16 (4.9)	18 (5.5)	18 (5.5)	-
54 (1350)	96 (2400)	-	17 (5.2)	18 (5.5)	18 (5.5)	-

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*NOTE: Any pipe installed at depths exceeding 18' (5.5m) shall require special approval from the County. Pipe depths exceeding 18' (5.5m) will not normally be permitted due to maintenance requirements. The above chart refers to depths permitted for structural integrity.

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10-0103.8 Permitted Materials

10-0103.8A Permitted sanitary sewer pipe materials shall include: Reinforced Concrete Pipe, Ductile Iron (minimum thickness class 51), Cast Iron (minimum thickness class 22) and Polyvinyl Chloride (PVC SDR 35).

10-0103.8B Other suitable sanitary sewer pipe materials may be used subject to express approval of the Board and such approval may include reasonable conditions, including, but not limited to, a performance and maintenance bond.

10-0103.8C Special Installation Details – PVC Pipe

10-0103.8C(1) (59-97-PFM) Pipe and Fitting Material: Shall be PVC sewer pipe and fittings, SDR-35 wall thickness conforming to ASTM Standard D 3034-89 in sizes 8" through 15" (200mm through 375mm) and ASTM Standard F 679-89 in sizes 18" through 27" (450mm through 675mm).

10-0103.8C(2) (59-97-PFM) Joints: PVC pipe and fitting joints shall be gasketed conforming to ASTM Standard D3212-92. Gaskets shall conform to ASTM Standard F 477-90.

10-0103.8C(3) (59-97-PFM) Fittings: PVC fittings of 8" (200mm) shall be molded in one piece. Fittings in sizes 10" through 27" (250mm through 675mm) shall be fabricated in accordance with ASTM Standard D 3034-89.

10-0103.8C(4) Installation: PVC pipe and fittings shall be installed in accordance with ASTM Standard D-2321, except as modified in the PFM.

10-0103.8C(5) Pipe Stiffness: Minimum pipe stiffness shall be 46 PSI (317 kPa) at maximum 5% deflection when tested in accordance with ASTM D-43.6.

10-0103.8C(6) In Place PVC Pipe Deflection Testing: Where soil conditions, installation procedures, or TV inspections warrant, manhole to manhole deflection testing may be required at the request of the County. Maximum allowable pipe deflection shall be 7 1/2%.

10-0103.8C(7) (30-90-PFM) Deflection tests shall be accomplished by the use of a multi-arm "go/nogo"

mandrel. Exact method of testing procedure shall be as per ASTM D3034-85b.

10-0103.9 (45-94-PFM) Slope Anchorage. Concrete anchors shall be placed on sanitary sewer lines with grades of 20% or greater and lines shall be ductile iron pipe. (Anchorage shall be shown as special detail on plans.) Minimum anchorage is as follows:

10-0103.9A Not over 36' (11m) center to center on grades of 20% and up to 35%.

10-0103.9B Not over 24' (7.3m) center to center on grades of 35% and up to 50%.

10-0103.9C Not over 16' (4.9m) center to center on grades of 50% and over.

10-0103.10 Minimum Permissible Depth

10-0103.10A Sanitary sewers installed where subjected to vehicle traffic shall generally be placed with a minimum cover of 6' (1.8m).

10-0103.10B Sewers at a more shallow depth shall be protected from loads or effects of traffic on the basis of HS-20 highway loading.

10-0103.10C Minimum cover for sewers in rights-of-way with no highway traffic to be 3' (900mm).

10-0104 Preparation of Plans

10-0104.1 Preliminary Plats. Approval of preliminary plats by the Director, in areas served by sanitary sewers, septic tanks and drain fields, as required by the Subdivision Ordinance, shall require the following information:

10-0104.1A Proposed locations of sewers (with flow arrows), sewage pumping stations and treatment facilities, with provisions for maintenance access.

10-0104.1B Easements shall be provided to serve all off-site properties that would drain through the site. These easements shall be recorded.

10-0104.2 Construction Drawings. 6 prints of the plans and design analysis for all sewers 10" (250mm) in diameter or larger or, if required by the Director, 8" (200mm) in diameter, of the sanitary sewer

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installation to be installed in a subdivision as prepared by a PE or LS, shall be submitted to the Office of Site Development Services for approval. Such plans shall be in conformance with the foregoing design criteria and show the following information:

10-0104.2A Plans shall be drawn on sheets measuring 24" wide by 36" long or their metric equivalent. The upper half of the drawing shall show the sewer location in plan and the lower half, the profile of the sewer and of the ground surface.

10-0104.2B A general layout shall be provided, showing streets, lots and sanitary sewer location, on-site and off-site. Scale is to be used which will allow all information to be shown on 1 sheet.

10-0104.2C All manholes shall be located on the plan and on the profile. Bearings and distances of sewer lines shall be shown on the plans no later than the second submission phase of design and review.

10-0104.2D In addition to the sewers, the plan shall show location of existing structures, houses, the location of proposed or existing underground utilities, curbs, property lines, railroad crossings, culverts, and bridges, which cross the sewer line.

10-0104.2E The horizontal scale for profiles shall be the same as that used for the plan, but in no case be smaller than 1" = 100' (1:1000). The vertical scale shall in no case be smaller than 1" = 10' (1:100).

10-0104.2F The PE or LS has the option to submit a plan on one 24" by 36" sheet or their metric equivalent and a profile on another (see § 10-0104.6).

10-0104.2G Sewer sizes, manhole numbers and stationing shall be shown on the plan and repeated on the profile.

10-0104.2H Watertight castings and manhole strapping shall be shown where required. Standard castings are required when manholes are within proposed or existing traveled roadways, locking covers are required when manholes are within County maintenance easements, and watertight covers are required when manhole tops are subject to surface water inflow.

10-0104.2I Sewer grade, invert elevations at manholes, elevation top of casting, type of pipe, construction bulkhead, location of cradle, etc., and existing and proposed street grades shall be shown on the profile.

10-0104.2J Vicinity map at a scale not less than 1"= 400' (1:4800) shall be used as a cover sheet for all plans.

10-0104.2K Plan approval of any outside agency or jurisdiction involved (i.e., Arlington County, Cities of Fairfax, Alexandria and the Towns of Herndon, Vienna, Falls Church) shall be obtained by the County prior to plan approval.

10-0104.2L Sanitary Sewer General Notes

10-0104.2L(1) Tapping into existing manholes for a pipe 10" (250mm) or less will be done by coring. Pipe sizes 12" (300mm) in diameter and larger shall be done in accordance with § 10-0102.5G.

10-0104.2L(2) Line connection to the manhole may be made with an approved flexible sleeve or a short length of pipe with a joint within 2' (600mm) of the inside face of the manhole (see § 10-0102.5).

10-0104.2L(3) A "non-shrink grout" must be used any time grout is applied for sanitary sewer use, excluding inverts and benches.

10-0104.2L(4) When installing sanitary sewer laterals to a main line sewer, the connection shall be 2' (600mm) minimum distance from any pipe joint (center to center). This shall also apply to the distance between 2 laterals placed on 1 section of main line sewer.

10-0104.2L(5) Rubber plugs shall be installed in lift holes. Holes shall be filled with a non-shrink grout or mastic on outside face of manhole only.

10-0104.2L(6) Invert channels in terminal manholes shall be built at the same grade as the main line leaving the manhole, but not less than 8.33% (see § 10-0102).

10-0104.2L(7) (61-98-PFM) Ram-Nek Pioneer 301 Mastic, or approved equal, shall be used under all types of manhole frames not subject to HS-20 loading.

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10-0104.2L(8) (61-98-PFM) Manhole frames subject to HS-20 loading shall be set in an approved non-shrink grout.

10-0104.2L(9) (61-98-PFM) Products which meet or exceed the performance of Ram-Nek Pioneer 301 shall be used on the outside of the joint on all manholes between the manhole frame and cone section to provide a water-tight seal.

10-0104.2L(10) No dry mix concrete shall be allowed in conjunction with the installation of sanitary sewers.

10-0104.2L(11) Concrete adjustment rings shall be used when adjustment to the precast manhole top elevation exceeds 2" (50mm). Non-shrink grout with full bearing metal or masonry shims may be allowed for final slope adjustment. Total adjustment must not exceed 12" (300mm).

10-0104.2L(12) Invert channels for sanitary sewer may be precast or built in the field. The invert channel shall be smooth and circular in shape, conforming to the adjacent sewer pipe section. Changes in direction of flow shall be made with a smooth curve maintaining the same diameter as the adjacent pipe. Changes in size and grade of the channels shall be made gradually and evenly. The benches of the manhole shall be built with a slope of 12:1 to 6:1 from manhole wall to the midpoint of pipe. The invert channel depth shall be 1/2 times the diameter of the pipe (see § 10-0102).

10-0104.2L(13) (31-90-PFM) When installed under roadways, and/or easements planned for future roadways, backfill shall be compacted to not less than 95% of maximum density, in accordance with VDOT specifications, Sections 200, 302, 303, and 520. When installed in easements not planned for future development, backfill shall be compacted to not less than 85% of the theoretical maximum density, unless otherwise specified in accordance with VDOT specifications, Section 520.

10-0104.2L(14) Grading of easement areas shall comply with the lines and grades indicated on the approved plans. In general, all trenches and subgrade of easements shall be compacted to equal density of surrounding ground.

10-0104.2L(15) Final grade around trees in sanitary sewer easements and work areas shall conform to the Urban Forester's requirements as contained in § 12-0000 et seq.

10-0104.2L(16) Lateral connections to sanitary sewer lines shall not be permitted within 5' (1.5m) of the outside wall of a terminal manhole. A manufactured "Y" shall be used for all connections within the first 10' (3m).

10-0104.2L(17) After all utilities, including curb and gutter have been installed, the Environmental and Facilities Inspections Division will request the Waste Water Collection Division (WWCD) to make a TV inspection of the sewer. Minimum preparation for TV inspection of outfall sewer requires that:

10-0104.2L(17)(a) Suitable access shall be provided for TV equipment to be driven to each manhole.

10-0104.2L(17)(b) All manholes and lines shall be cleaned prior to TV inspection.

10-0104.2L(17)(c) All bulkheads in the area to be TV inspected shall be removed 48 hr prior to TV inspection, and replaced 48 hr following the inspection (pending RUP approval).

10-0104.3 Application for Sewerage Service

10-0104.3A Before approval of construction drawings can be made, all off-site sanitary sewer easements shall be obtained and recorded.

10-0104.3B When sewers are to be served by the County's integrated sewerage system, an "Application for Sewerage Service Requiring an Extension of Existing Facilities" shall be executed by the owner or developer and approved by the Director after meeting the requirements of the DEQ/VDH Local Plan Review Program.

10-0104.4 Bulkheads

10-0104.4A The objective of bulkheads is to eliminate extraneous water and debris from entering an active sewer system during various stages of construction and prior to the issuance of a RUP or Non-RUP.

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10-0104.4B Bulkheads shall be constructed of approved brick and cement mortar to withstand the water pressure and to provide a watertight seal.

10-0104.4B(1) Expansion plugs may be used in lieu of bulkheads where only 1 manhole is constructed.

10-0104.4B(2) An expansion plug may be used in lieu of bulkhead where PVC pipe is used.

10-0104.4C When sewer lines are ready for inspection via TV, bulkheads and expansion plugs shall be removed after the lines are cleared of debris, and pumped down, not more than 48 hr prior to the TV inspection request.

10-0104.4D Following completion of the TV inspection, bulkheads shall be replaced within 48 hr, unless RUPs, or Non-RUPs have been issued, and the sewer will be placed immediately in service.

10-0104.5 Building Laterals

10-0104.5A (72-01-PFM, 32-90-PFM) In subdivisions where the sanitary street sewer mains are being installed by the developer, the developer also shall install a lateral or extension from the sanitary sewer main to a minimum of 20' (6 m) beyond the property line or within 5 ft (1.5 m) of the minimum yard requirement, whichever distance is less, for Single-Family Detached lots, and to a minimum of 5 ft (1.5 m) beyond the property line or sanitary sewer easement, whichever distance is greater, for Single-Family Townhouse lots in accordance with Plates 23-10 (23M-10) and 24-10 (24M-10). This extension is to receive the building sewer for each lot.

10-0104.5A(1) Such extensions shall be shown on the sewer plans submitted to and approved by the Director and the extension shall be installed in the exact location as shown on the plan.

10-0104.5A(2) These laterals shall be constructed as specified in the VUSBC.

10-0104.5A(3) The lateral shall enter the sanitary sewer through a manufactured "Y", "T" or approved sewer saddle placed in the sanitary sewer by the developer at the exact location for proper alignment with the lateral.

10-0104.5A(4) The lateral shall be laid at the grades provided in the VUSBC.

10-0104.5A(5) House lateral connections to manholes shall be restricted to the following (does not apply in cases where a plumbing permit is required):

10-0104.5A(5)(a) Houses on cul-de-sacs from which a plumbing connection would require a circuitous route to connect to the sewer line.

10-0104.5A(5)(b) Collector line encased in concrete or of ductile iron.

10-0104.5A(5)(c) Invert elevations of house lateral connections at manhole wall shall conform to § 10-0102.5H.

10-0104.5A(6) The laterals and saddles shall be inspected and tested by DPWES along with and at the same time inspections are being made for the installation of the sanitary sewer.

10-0104.5A(7) After a building is connected through a lateral to the sanitary sewer, the lateral shall become a part of the building, and the owner of the premises shall be responsible for the operation and maintenance of the entire building sewer between the building and the street sewer as set forth in § 65-7-5 of the Code.

10-0104.5B Construction drawings for developments where these laterals are to be installed show the following information:

10-0104.5B(1) Station of branch, length and direction of lateral, pipe size and percent of grade shall be shown on the plan.

10-0104.5B(2) Station of branch and invert elevation and finished ground elevations at end of lateral shall be shown on profile.

10-0104.5C Cut sheets shall show the station of the branch, length and grade of the lateral, invert elevation of end of the lateral and cut from hub to invert.

10-0104.5D Inspection: No additional allowance for infiltration shall be made for laterals.

10-0104.6 As-built drawings.

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10-0104.6A As-built drawings shall be submitted to the Director as a condition precedent to the acceptance of the facilities.

10-0104.6B As-built drawings shall be:

10-0104.6B(1) Prepared on mylar reproducibles, with the plan and the corresponding profile on the same sheet.

10-0104.6B(2) Prepared showing the as-built facilities as actually built. The deed book and page numbers of all easements shall be shown on the applicable plan and profile sheet.

10-0104.6B(3) Prepared by a PE or LS.

10-0104.6B(4) Prepared showing, in addition to the information required on the construction drawings, deflection angles or bearing and distance between manholes. For all subdivisions on the Virginia coordinate system, coordinates of all manholes along the subtrunk and trunk facilities shall also be provided. When the as-built information differs from the approved construction plans, a design analysis for the existing conditions may be required.

10-0104.7 Certificate to Operate

10-0104.7A No RUP or Non-RUP shall be issued where a building is hooked to a new sanitary sewer line until an acceptance test and TV inspection indicates that construction conforms to the specifications and criteria.

10-0104.7B Structural repairs to pipe (i.e., holes, crushed or slipped joints), required as a result of TV inspection, shall be made in accordance with the guidelines prepared by the Office of Waste Management, WWCD, and § 10-0104.7C et seq. Location and type of repair shall be noted on the WWCD copy of the TV report (PVC SDR 35 is covered by manufacturer's specifications).

10-0104.7C Repair Situations:

10-0104.7C(1) Hole in pipe above spring line

10-0104.7C(2) Hole in pipe below spring line

10-0104.7C(3) Pipe with shear crack or full break

10-0104.7C(4) Crushed section or sections of pipe

10-0104.7C(5) Slipped or leaking joints

10-0104.7D Repair Definitions:

10-0104.7D(1) Hole in pipe above spring line. A hole in that portion of the pipe located in the area above the centerline of said pipe, and not to exceed 3" (75mm) as measured in any direction.

10-0104.7D(2) Hole in pipe below spring line. A hole in that portion of the pipe located in the area below the centerline of said pipe.

10-0104.7D(3) Pipe with shear crack or full break. A structural defect in a pipe from a hairline crack to a full break induced by ground settlements or compressive hooding and in a general vertical plane.

10-0104.7D(4) Crushed section or sections of pipe. A partial or total structural collapse of the pipe, a portion of pipe with an area exceeding that defined as a hole (see § 10-0104.7D(1)).

10-0104.7D(5) Slipped or defective joints. An open joint, misalignment of joint, damaged joint or dropped joint.

10-0104.7E General Repair Guidelines for AC and Concrete Pipe.

10-0104.7E(1) Hole in pipe above spring line. A repair of this nature by the use of a clamp as specified by the County under the criteria of application will be an acceptable means of repair. (See Plate 25-10 (25M-10)).

10-0104.7E(2) Hole in pipe below spring line. A repair of this nature will be done by the replacement of such pipe as required (see Plate 26-10 (26M-10)).

10-0104.7E(3) Pipe with shear crack or full break. Repair of a shear crack or full break in a pipe by the use of a clamp as specified by the Director under the criteria of application will be an acceptable means of repair (see Plate 27-10 (27M-10)).

10-0104.7E(4) Crushed section or sections of pipe. Repair of crushed section or sections of pipe will be done by the replacement of such pipe (see Plate 28-10 (28M-10)).

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10-0104.7E(5) Slipped or leaking joints (see Plate 28-10 (28M-10)).

10-0104.7E(5)(a) Repair of slipped joints may be done by a mechanical means such as jacking, in order to properly realign same. Such excavation will be carried out as required to afford the proper protection to the line while the repair is being made.

10-0104.7E(5)(b) Repair of leaking joints may be made by an approved grouting method as specified by the Director.

10-0104.7E(6) When a stainless steel band (clamp) is used for any repairs or collar replacement, it shall be no less than 12" (300mm) in width.

10-0104.7E(7) When repairing a sewer line by replacing a section of the pipe, stainless steel bands must be used. The gap in the joint connection shall not exceed 3/4" (19mm).

10-0104.7F Location of Repairs.

10-0104.7F(1) Location of sanitary sewer pipe repairs will be reported to WWCD, DPWES, to be made part of the as-built records.

10-0104.7F(2) Location of each repair will be measured from the manhole on each side of the repair.

10-0104.7F(3) The type of repair situation will be noted.

10-0104.7F(4) When pipe is required to be removed and replaced, the length and number of repair clamps used will be noted.

10-0104.8 Final Approval. Final approval for the satisfactory compliance with the provisions of the "Application for Sewerage Service" shall not be given until all site work is complete and the as-built plan is submitted to and approved by the Director.

10-0105 Acceptance Tests. (43-94-PFM) An acceptance test shall be specified for all gravity sewer lines. The test may be a water test, an air test, or a vacuum test.

10-0105.1 (43-94-9PFM) Where water testing is used (infiltration or exfiltration), the leakage outward

or inward shall not exceed 100 gal./in. (9.3 L/mm) of nominal pipe diameter per mile (kilometer) per day (4800 GPD/mi. (11290 LPD/km) maximum) for any section of the system including manholes.

10-0105.1A (43-94-PFM) Where the exfiltration test is used, the line shall be subjected to a minimum of 4' (1.2m) of head, or head to the top of the manhole, whichever is the lesser, above the crown of the pipe at the upstream manhole of the section being tested.

10-0105.1B The infiltration test shall be allowed only when it can be shown that the hydrostatic head outside the pipe is a minimum of 4' (1.2m) above the crown of the pipe for the entire length of the pipe being tested.

10-0105.2 (43-94-PFM) Where air testing is used, test methods and acceptability criteria shall be in accordance with the appropriate ASTM specifications. Air testing shall generally be acceptable for all types of pipe materials.

10-0105.2A (43-94-PFM) If air testing is used, the manholes shall be tested by exfiltration.

10-0105.2A(1) Inflatable stoppers shall be used to plug all lines into and out of the manhole being tested.

10-0105.2A(2) The stoppers shall be positioned in the lines far enough from the manhole to ensure testing to those portions of the lines not air tested.

10-0105.2A(3) The manhole shall then be filled with water to a level 4' (1.2m) above the top of the pipe. A 24-hr soak shall be allowed.

10-0105.2A(4) Leakage shall not exceed 1/2 gal./hr (1.9 L/hr). Manholes determined to be suspected to poor quality, jointing or construction practices by the engineer shall be tested to the top of the manhole.

10-0105.2B The contractor shall furnish weirs, stand pipes, pipe plugs, water, pressure gauges, stop watches, air compressor, hose and such materials and assistance as required to perform these tests. All acceptance tests shall be conducted by the contractor in the presence of an inspector from the

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Environmental and Facilities Inspections Division, DPWES.

10-0105.2C Acceptance tests shall not be made until the sanitary sewer, manholes and required building laterals, as shown on approved street plans, have been installed, the sewer trenches backfilled to a minimum of 6' (1.8m) of finished grade and compacted.

10-0105.2D All sanitary sewers, including manholes, shall be inspected prior to acceptance testing, and any water leakage into the system sufficient to constitute any noticeable trickle or dribble, first shall be corrected and eliminated prior to undertaking the acceptance test.

10-0105.2E Wherever it has been necessary to construct underdrains or place gravel under pipe lines in order to dewater the trench during construction of the sewers, the acceptance test shall not be made until any pumps (which have been used in the dewatering process) have been disconnected.

10-0105.2F The contractor shall schedule all acceptance tests with the Environmental and Facilities Inspections Division at least 2 County working days in advance.

10-0105.2F(1) Each section of completed sewer shall be tested.

10-0105.2F(2) Generally, the sewers shall be tested from manhole to manhole.

10-0105.2F(3) No sewers or building lateral connections shall be excluded from this testing procedure.

10-0105.3 Low Pressure Air Testing Procedure:

10-0105.3A The contractor shall thoroughly clean and remove all debris, silt, earth, or other material from the sewer prior to acceptance testing. The pipe may be flushed with water or cleaned by mechanical means. None of this water or debris shall be allowed to enter the existing sewer.

10-0105.3B Test plugs shall be supplied and installed by the contractor within the pipe at each manhole or at suitable locations to test a section of the pipe. Each plug shall be securely braced as necessary.

10-0105.3C If the pipe to be tested is expected to be below the ground water table, the contractor shall either:

10-0105.3C(1) Install a small diameter perforated vertical pipe from the invert elevation of the sewer to the surface prior to backfilling, or

10-0105.3C(2) Insert a pipe probe by boring or driving into the backfill material adjacent to the invert elevation of the pipe, and determine the depth of the ground water level above the pipe invert immediately prior to acceptance testing the sewer.

10-0105.3D All gauge pressures in the test shall be increased by the amount of this back pressure due to ground water submergence over the end of the probe. In no case shall the starting test pressure exceed 9 PSI (62 kPa). See Table 10.7 for correlation of ground water height to PSI (kPa).

TABLE 10.7 CORRELATION OF VERTICAL FEET (METER) OF WATER TO PRESSURE IN PSI (kPa)

Equivalent PSI (kPa)		Height of Ground Water Above Pipe Invert ft (m)	
0.43	(2.45)	1	(0.25)
0.87	(4.90)	2	(0.50)
1.30	(7.35)	3	(0.75)
1.73	(9.81)	4	(1.0)
2.17	(12.26)	5	(1.25)
2.60	(14.71)	6	(1.5)
3.03	(17.16)	7	(1.75)
3.47	(19.61)	8	(2.0)
3.90	(22.06)	9	(2.25)
4.34	(24.52)	10	(2.5)
4.77	(26.97)	11	(2.75)
4.98	(29.42)	11.5	(3.0)
—	(31.87)	—	(3.25)
—	(34.32)	—	(3.5)

For anything above 11.5 VF (3.5 VM), allow maximum 5.0 PSI (34.5 kPa)

NOTES:

1. Table based on 1 (0.25) vertical ft (meter) water = 0.4335 PSI (2.45151 kPa).

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2. The appropriate PSI (kPa) allowance for average vertical feet (meter) of ground water shall be added to the base starting pressure of 4.0 PSI (28 kPa), but in no case shall the resulting starting pressure be more than 9.0 PSI (62 kPa).
3. Interpolate for decimals of a foot (meter) of water.

10-0105.3E The contractor shall add air slowly to the portion of the pipe under test until the internal air pressure is raised to 4 PSI (28 kPa) greater than the average back pressure of any ground water above the invert of the pipe.

10-0105.3F As a safety precaution, no one shall be allowed in a manhole after the air pressure is increased in the sewer line. If the Environmental and Facilities Inspector suspects that the test plug may be leaking, the pressure first shall be relieved before any adjustments are made to eliminate air leakage at the plug. The contractor may precoat the plug with a soap solution to check the plugs for leakage.

10-0105.3G The contractor shall allow the air temperature to stabilize for at least 2 minutes with the pipe subjected to an internal pressure of 4 PSI (28 kPa) greater than the average ground water back pressure by adding only the amount of air required to maintain this pressure.

10-0105.3H If the internal air pressure decreases, the time required for the pressure drop from 3 1/2 to 3 PSI (24 to 21 kPa) greater than the average ground water back pressure will be observed and recorded. This time interval shall be compared with the established standards in accordance with the approved table of time and length for various diameters of sewer (Table 10.8 and 10.9).

**TABLE 10.8 AIR TEST TABLE - MINIMUM HOLDING TIME IN MINUTES
REQUIRED FOR PRESSURE DROP FROM 3.5 TO 3.0 PSI (24 TO 21 kPa)**

	LENGTH OF LINE IN FEET												
	PIPE DIAMETER IN INCHES												
	4	6	8	10	12	15	18	21	24	27	30	33	36
25	2.8	4.2	5.7	7.1	8.5	10.6	12.7	14.8	17.0	19.2	21.2	23.3	25.5
50	2.8	4.2	5.7	7.1	8.5	10.6	12.7	14.8	17.0	19.2	21.2	23.3	25.5
75	2.8	4.2	5.7	7.1	8.5	10.6	12.7	14.8	17.0	19.2	21.2	24.3	28.8
100	2.8	4.2	5.7	7.1	8.5	10.6	12.7	14.8	17.0	21.6	26.8	32.2	38.5
125	2.8	4.2	5.7	7.1	8.5	10.6	12.7	16.3	21.2	27.0	33.3	40.1	48.2
150	2.8	4.2	5.7	7.1	8.5	10.6	14.3	19.6	25.5	32.6	40.1	48.3	57.6
175	2.8	4.2	5.7	7.1	8.5	11.6	16.7	22.8	29.7	37.9	46.7	56.2	67.3
200	2.8	4.2	5.7	7.1	8.5	13.3	19.1	26.1	34.0	43.3	53.5	64.4	77.0
225	2.8	4.2	5.7	7.1	9.5	15.0	21.5	29.4	38.2	48.7	60.1	72.3	86.7
250	2.8	4.2	5.7	7.4	10.6	16.7	24.0	32.6	42.5	54.0	66.9	80.5	96.1
275	2.8	4.2	5.7	8.1	11.7	18.3	26.3	35.9	46.7	59.6	73.5	88.4	105.8
300	2.8	4.2	5.7	8.9	12.7	20.0	28.7	39.1	51.0	65.0	80.3	96.6	115.5
350	2.8	4.2	6.6	10.4	14.9	23.4	33.4	45.7	59.5	75.7	93.7	112.7	134.6
400	2.8	4.2	7.6	11.9	17.0	26.7	38.2	52.2	68.0	86.6	107.1	128.8	154.0
450	2.8	4.8	8.5	13.4	19.1	30.0	43.0	58.7	76.5	97.4	120.5	144.9	173.1
500	2.8	5.3	9.5	14.9	21.2	33.3	47.8	65.3	85.0	108.3	133.9	161.0	192.5

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	LENGTH OF LINE IN METERS												
	PIPE DIAMETER IN MILLIMETERS												
	100	150	200	250	300	375	450	525	600	675	750	825	900
7.5	2.8	4.2	5.7	7.1	8.5	10.6	12.7	14.8	17.0	19.2	21.2	23.3	25.5
15	2.8	4.2	5.7	7.1	8.5	10.6	12.7	14.8	17.0	19.2	21.2	23.3	25.5
22.5	2.8	4.2	5.7	7.1	8.5	10.6	12.7	14.8	17.0	19.2	21.2	24.3	28.8
30	2.8	4.2	5.7	7.1	8.5	10.6	12.7	14.8	17.0	21.6	26.8	32.2	38.5
37.5	2.8	4.2	5.7	7.1	8.5	10.6	12.7	16.3	21.2	27.0	33.3	40.1	48.2
45	2.8	4.2	5.7	7.1	8.5	10.6	14.3	19.6	25.5	32.6	40.1	48.3	57.6
52.5	2.8	4.2	5.7	7.1	8.5	11.6	16.7	22.8	29.7	37.9	46.7	56.2	67.3
60	2.8	4.2	5.7	7.1	8.5	13.3	19.1	26.1	34.0	43.3	53.5	64.4	77.0
67.5	2.8	4.2	5.7	7.1	9.5	15.0	21.5	29.4	38.2	48.7	60.1	72.3	86.7
75	2.8	4.2	5.7	7.4	10.6	16.7	24.0	32.6	42.5	54.0	66.9	80.5	96.1
82.5	2.8	4.2	5.7	8.1	11.7	18.3	26.3	35.9	46.7	59.6	73.5	88.4	105.8
90	2.8	4.2	5.7	8.9	12.7	20.0	28.7	39.1	51.0	65.0	80.3	96.6	115.5
105	2.8	4.2	6.6	10.4	14.9	23.4	33.4	45.7	59.5	75.7	93.7	112.7	134.6
120	2.8	4.2	7.6	11.9	17.0	26.7	38.2	52.2	68.0	86.6	107.1	128.8	154.0
135	2.8	4.8	8.5	13.4	19.1	30.0	43.0	58.7	76.5	97.4	120.5	144.9	173.1
150	2.8	5.3	9.5	14.9	21.2	33.3	47.8	65.3	85.0	108.3	133.9	161.0	192.5

NOTES:

1. Air Test Table based on Ramseier's Equation $T = 0.085 DK/Q$; $Q = 0.0010 \text{ ft}^3/\text{minute}^3$.
2. For testing 4" (100mm) laterals with sewer main, add 2.8 minutes to appropriate sewer main test time.

TABLE 10.9 CORRELATION – TENTHS OF MINUTES TO SECONDS

MINUTES	.1	.2	.3	.4	.5	.6	.7	.8	.9
SECONDS	6	3.6	18	24	30	36	42	48	54

10-0105.3I Pipe which fails to maintain the stipulated pressure for a period equal to or greater than the holding time shown in the approved tables shall be deemed to have failed to pass the low pressure air test and is unsatisfactory for acceptance by the Environmental and Facilities Inspector. Any sewer or house connection that fails to pass this test shall be repaired by the contractor. Following corrections, the sanitary sewer shall be tested again in accordance with the enumerated procedures.

10-0105.3J For accuracy and safety precautions, air tests shall be limited to the diameters of pipe and lengths of pipe indicated in the air test table of time, Table 10.8.

10-0105.3K Pressure gauges used in the air test procedure shall have a minimum 4" (100mm) diameter face, a range of 0 to 10 PSI or metric equivalent in kPa, shall be calibrated in divisions of 0.10 psi or metric equivalent in kPa, and have an accuracy of plus or minus 1%.

10-0105.3L For air testing pipes of larger diameter than 36" (900mm), a thorough visual inspection shall be required and all joints shall be tested with a special joint testing device such as the Cherge "Jointester" System, or approved equal. Testing procedure shall be as recommended by the approved joint tester manufacturer.

10-0105.4 Infiltration Testing:

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10-0105.4A Infiltration testing shall be permitted when the section of pipe being tested is subjected to a minimum hydrostatic head of 4' (1.2m) for the total length of the line under test.

10-0105.4B The allowable leakage permitted is 100 gal./in. (9.3 L/mm) of nominal pipe diameter per mile (kilometer) per day with a maximum allowable leakage of 4,800 GPD/mi. (11290 LPD/km). When infiltration tests are proposed, the methods of determining this flow must be approved by the Office of Site Development Services, DPWES, prior to performance of the test.

10-0105.5 Exfiltration Testing:

10-0105.5A All service laterals, stubs and fittings into the sewer lines being tested should be properly capped or plugged, and carefully braced to resist the thrust actions developed by the internal water pressure.

10-0105.5A(1) In preparing the blocking of plugs or end caps, it is extremely important to recognize that the 5' to 10' (1.5m to 3m) of head in the standpipe will exert considerable thrusts against the plugs or caps.

10-0105.5A(2) For example, a 10' (3m) head will generate a total force of 215 lb (956N) against a 8" (200mm) plug.

10-0105.5A(3) Further consideration must be given to the fact that greater pressures will be developed in the downstream portion of the line, due to lower elevations, than in the upper reaches of the sewer line.

10-0105.5B A tapped plumber's type plug is inserted and tightened in the inlet pipe of the downstream manhole to which the water supply connection is made for filling the pipe (see Plate 29-10 (29M-10)).

10-0105.5C The upper manhole is plugged and securely tightened for connection to the standpipe. The standpipe is then placed in this manhole and connected to the tapped plug. The standpipe must be capable of handling from 5' to 10' (1.5m to 3m) of water head to determine the tightness and soundness of the sewer line, as specified and directed by the inspector.

10-0105.5D Water is introduced into the line at the downstream (lower) manhole until the standpipe in the upstream manhole has been completely filled.

10-0105.5D(1) By filling the line from the lowest level, the air in the line is easily pushed ahead and finally expelled through the standpipe at the upper end of the test section.

10-0105.5D(2) Care must be taken to minimize entrapped air which will give distorted test results.

10-0105.5D(3) The rate of drop in the standpipe may be quite rapid until the air has been expelled.

10-0105.5E After filling with water, the line must be allowed to stand for a minimum of 3.6 hr before beginning the test. During this time some water absorption into the manhole structures and asbestos cement sewer pipe will take place. After the water absorption has stabilized, the water level in the standpipe is checked and water added if necessary.

10-0105.5F The test is now ready to begin. The drop in the standpipe is measured and recorded over a 10 minute period. To verify the first results, a second 10 minute test is suggested. This will also verify whether a stable condition exists in the line.

10-0105.5G The measured drops in the standpipe are converted to leakage in terms of gal./in. (L/mm) of nominal pipe diameter per mile (kilometer) per day, the acceptable method of recording leakage.

10-0105.5H Caution shall be taken about conducting exfiltration tests on sewer lines laid on steep grades.

10-0105.5H(1) Consideration must be given to the downstream portion of the system to prevent excessive pressure in these lower lines. For these installations and where the upstream manholes are very deep, it is not advisable to fill the standpipe or manhole to the top when performing the test.

10-0105.5H(2) Tables showing allowable exfiltration rates in a 3" (75mm) standpipe are provided in Tables 10.10 thru 10.16.

10-0105.6 (43-94-PFM) Where vacuum testing is used, the test method and acceptability criteria shall be in accordance with ASTM C-3.644.

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TABLE 10.10

**WATER TEST TABLE
ALLOWABLE DROP IN 3" (75mm) STAND PIPE
PER 10 MINUTES**

8" (200mm) DIAMETER

\\LENGTH OF SPUR IN FEET, 4" DIAMETER																
	LENGTH OF MAIN LINE IN FEET – 8" DIAMETER															
	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
0	.07	.14	.21	.29	.36	.43	.50	.57	.64	.72	.79	.86	.93	1.00	1.07	1.15
25	.11	.18	.24	.32	.39	.46	.53	.60	.67	.75	.82	.89	.96	1.03	1.10	1.18
50	.14	.21	.28	.36	.43	.50	.57	.64	.71	.79	.86	.93	1.00	1.07	1.14	1.22
75	.18	.25	.31	.39	.46	.53	.60	.67	.74	.82	.89	.96	1.03	1.10	1.17	1.25
100	.21	.28	.35	.43	.50	.57	.64	.71	.78	.86	.93	1.00	1.07	1.14	1.21	1.29
125	.25	.32	.38	.46	.53	.60	.67	.74	.81	.89	.96	1.03	1.10	1.17	1.24	1.32
150	.28	.35	.42	.50	.57	.64	.71	.78	.85	.93	1.00	1.07	1.14	1.21	1.28	1.36
175	.32	.39	.46	.54	.61	.68	.75	.82	.89	.97	1.04	1.11	1.18	1.25	1.32	1.40
200	.36	.43	.49	.57	.64	.71	.78	.85	.92	1.00	1.07	1.14	1.21	1.28	1.35	1.43
225	.39	.46	.53	.61	.68	.75	.82	.89	.96	1.04	1.11	1.18	1.25	1.32	1.39	1.47
250	.43	.50	.56	.64	.71	.78	.85	.92	.99	1.07	1.14	1.21	1.28	1.35	1.42	1.50
275	.46	.53	.60	.68	.75	.82	.89	.96	1.03	1.11	1.18	1.25	1.32	1.39	1.46	1.54
300	.50	.57	.63	.71	.78	.85	.92	.99	1.06	1.14	1.21	1.28	1.35	1.42	1.49	1.57

\\LENGTH OF SPUR IN METERS, 100mm DIAMETER																
	LENGTH OF MAIN LINE IN METERS – 200mm DIAMETER															
	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
0	0.022	0.044	0.066	0.088	0.110	0.131	0.153	0.175	0.197	0.219	0.241	0.263	0.285	0.307	0.329	0.351
75	0.033	0.055	0.077	0.099	0.121	0.142	0.164	0.186	0.208	0.230	0.252	0.274	0.296	0.318	0.340	0.362
15	0.044	0.066	0.088	0.110	0.131	0.153	0.175	0.197	0.219	0.241	0.263	0.285	0.307	0.329	0.351	0.373
22.5	0.055	0.077	0.099	0.121	0.142	0.164	0.186	0.208	0.230	0.252	0.274	0.296	0.318	0.340	0.362	0.384
30	0.066	0.088	0.110	0.131	0.153	0.175	0.197	0.219	0.241	0.263	0.285	0.307	0.329	0.351	0.373	0.394
37.5	0.077	0.099	0.121	0.142	0.164	0.186	0.208	0.230	0.252	0.274	0.296	0.318	0.340	0.362	0.384	0.405
45	0.088	0.110	0.131	0.153	0.175	0.197	0.219	0.241	0.263	0.285	0.307	0.329	0.351	0.373	0.394	0.416
52.5	0.099	0.121	0.142	0.164	0.186	0.208	0.230	0.252	0.274	0.296	0.318	0.340	0.362	0.384	0.405	0.427
60	0.110	0.131	0.153	0.175	0.197	0.219	0.241	0.263	0.285	0.307	0.329	0.351	0.373	0.394	0.416	0.438
67.5	0.121	0.142	0.164	0.186	0.208	0.230	0.252	0.274	0.296	0.318	0.340	0.362	0.384	0.405	0.427	0.449
75	0.131	0.153	0.175	0.197	0.219	0.241	0.263	0.285	0.307	0.329	0.351	0.373	0.394	0.416	0.438	0.460
82.5	0.142	0.164	0.186	0.208	0.230	0.252	0.274	0.296	0.318	0.340	0.362	0.384	0.405	0.427	0.449	0.471
90	0.153	0.175	0.197	0.219	0.241	0.263	0.285	0.307	0.329	0.351	0.373	0.394	0.416	0.438	0.460	0.482

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TABLE 10.11

**WATER TEST TABLE
ALLOWABLE DROP IN 3" (75mm) STAND PIPE
PER 10 MINUTES
10" (250mm) DIAMETER**

\\LENGTH OF SPUR IN FEET, 4" DIAMETER																
	LENGTH OF MAIN LINE IN FEET – 8" DIAMETER															
	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
0	.09	.17	.26	.35	.44	.53	.62	.71	.80	.89	.98	1.07	1.16	1.25	1.34	1.43
25	.12	.20	.29	.38	.47	.56	.65	.74	.83	.92	1.01	1.10	1.19	1.28	1.37	1.46
50	.16	.24	.33	.42	.51	.60	.69	.78	.87	.96	1.05	1.14	1.23	1.32	1.41	1.50
75	.19	.27	.36	.45	.54	.63	.72	.81	.90	.99	1.08	1.17	1.26	1.35	1.44	1.53
100	.23	.31	.40	.49	.58	.67	.76	.85	.93	1.03	1.12	1.21	1.30	1.39	1.48	1.57
125	.26	.34	.43	.52	.61	.70	.79	.88	.97	1.06	1.15	1.24	1.33	1.42	1.51	1.60
150	.30	.38	.47	.56	.65	.74	.83	.92	1.01	1.10	1.19	1.28	1.37	1.46	1.55	1.64
175	.34	.42	.51	.60	.69	.78	.87	.96	1.04	1.14	1.23	1.32	1.41	1.50	1.59	1.68
200	.37	.45	.54	.63	.72	.81	.90	.99	1.08	1.17	1.26	1.35	1.44	1.53	1.62	1.71
225	.41	.49	.58	.67	.76	.85	.94	1.03	1.12	1.21	1.30	1.39	1.48	1.57	1.66	1.74
250	.44	.52	.61	.70	.79	.88	.97	1.06	1.15	1.24	1.33	1.42	1.51	1.60	1.69	1.78
275	.48	.56	.65	.74	.83	.92	1.01	1.10	1.18	1.28	1.37	1.46	1.55	1.64	1.73	1.81
300	.51	.59	.68	.77	.86	.95	1.04	1.13	1.28	1.31	1.60	1.49	1.58	1.67	1.76	1.86

\\LENGTH OF SPUR IN METERS, 100mm DIAMETER																
	LENGTH OF MAIN LINE IN METERS – 250mm DIAMETER															
	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
0	0.027	0.055	0.082	0.110	0.137	0.164	0.192	0.219	0.247	0.274	0.301	0.329	0.356	0.384	0.411	0.438
7.5	0.038	0.066	0.093	0.121	0.148	0.175	0.203	0.230	0.258	0.285	0.312	0.340	0.367	0.394	0.422	0.449
15	0.049	0.077	0.104	0.131	0.159	0.186	0.214	0.241	0.268	0.296	0.323	0.351	0.378	0.405	0.433	0.460
22.5	0.060	0.088	0.115	0.142	0.170	0.197	0.225	0.252	0.279	0.307	0.334	0.362	0.389	0.416	0.444	0.471
30	0.071	0.099	0.126	0.153	0.181	0.208	0.236	0.263	0.290	0.318	0.345	0.373	0.400	0.427	0.455	0.482
37.5	0.082	0.110	0.137	0.164	0.192	0.219	0.247	0.274	0.301	0.329	0.356	0.384	0.411	0.438	.0466	0.493
45	0.093	0.121	0.148	0.175	0.203	0.230	0.258	0.285	0.312	0.340	0.367	0.394	0.422	0.449	0.477	0.504
52.5	0.104	0.131	0.159	0.186	0.214	0.241	0.268	0.296	0.323	0.351	0.378	0.405	0.433	0.460	0.488	0.515
60	0.115	0.142	0.170	0.197	0.225	0.252	0.279	0.307	0.334	0.362	0.389	0.416	0.444	0.471	0.499	0.526
67.5	0.126	0.153	0.181	0.208	0.236	0.263	0.290	0.318	0.345	0.373	0.400	0.427	0.455	0.482	0.510	0.537
75	0.137	0.164	0.192	0.219	0.247	0.274	0.301	0.329	0.356	0.384	0.411	0.438	.0466	0.493	0.520	0.548
82.5	0.148	0.175	0.203	0.230	0.258	0.285	0.312	0.340	0.367	0.394	0.422	0.449	0.477	0.504	0.531	0.559
90	0.159	0.186	0.214	0.241	0.268	0.296	0.323	0.351	0.378	0.405	0.433	0.460	0.488	0.515	0.542	0.570

10-0000 SEWAGE AND SOLID WASTE DISPOSAL

TABLE 10.12

**WATER TEST TABLE
ALLOWABLE DROP IN 3" (75mm) STAND PIPE
PER 10 MINUTES
12" (300mm) DIAMETER**

\\LENGTH OF SPUR IN FEET, 4" DIAMETER																
	LENGTH OF MAIN LINE IN FEET – 12" DIAMETER															
	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
0	.10	.21	.32	.42	.53	.64	.75	.85	.96	1.07	1.18	1.28	1.39	1.50	1.61	1.71
25	.13	.24	.35	.45	.56	.67	.78	.88	.99	1.10	1.21	1.31	1.42	1.53	1.64	1.74
50	.17	.28	.39	.49	.60	.71	.82	.92	1.03	1.14	1.25	1.35	1.46	1.57	1.68	1.78
75	.20	.31	.42	.52	.63	.74	.85	.95	1.06	1.17	1.28	1.38	1.49	1.60	1.71	1.81
100	.24	.35	.46	.56	.67	.78	.89	.99	1.10	1.21	1.32	1.42	1.53	1.64	1.75	1.85
125	.27	.38	.49	.59	.70	.81	.92	1.02	1.13	1.24	1.35	1.45	1.56	1.67	1.78	1.88
150	.31	.42	.53	.63	.74	.85	.96	1.06	1.17	1.28	1.39	1.49	1.60	1.71	1.82	1.92
175	.35	.46	.57	.67	.78	.89	1.00	1.11	1.21	1.32	1.43	1.53	1.64	1.75	1.86	1.96
200	.38	.49	.60	.70	.81	.92	1.03	1.13	1.24	1.35	1.46	1.56	1.67	1.78	1.89	1.99
225	.42	.53	.64	.74	.85	.96	1.07	1.17	1.28	1.39	1.50	1.60	1.71	1.82	1.93	2.03
250	.45	.56	.67	.77	.88	.99	1.10	1.20	1.31	1.42	1.53	1.63	1.74	1.85	1.96	2.06
275	.49	.60	.71	.81	.92	1.03	1.14	1.24	1.35	1.46	1.57	1.67	1.78	1.89	2.00	2.10
300	.52	.63	.74	.84	.95	1.06	1.17	1.27	1.38	1.49	1.60	1.70	1.81	1.92	2.03	2.13

\\LENGTH OF SPUR IN METERS, 100mm DIAMETER																
	LENGTH OF MAIN LINE IN METERS – 300mm DIAMETER															
	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
0	0.033	0.066	0.099	0.131	0.164	0.197	0.230	0.263	0.296	0.329	0.362	0.394	0.427	0.460	0.493	0.526
7.5	0.044	0.077	0.110	0.142	0.175	0.208	0.241	0.274	0.307	0.340	0.373	0.405	0.438	0.471	0.504	0.537
15	0.055	0.088	0.121	0.153	0.186	0.219	0.252	0.285	0.318	0.351	0.384	0.416	0.449	0.482	0.515	0.548
22.5	0.066	0.099	0.131	0.164	0.197	0.230	0.263	0.296	0.329	0.362	0.394	0.427	0.460	0.493	0.526	0.559
30	0.077	0.110	0.142	0.175	0.208	0.241	0.274	0.307	0.340	0.373	0.405	0.438	0.471	0.504	0.537	0.570
37.5	0.088	0.121	0.153	0.186	0.219	0.252	0.285	0.318	0.351	0.384	0.416	0.449	0.482	0.515	0.548	0.581
45	0.099	0.131	0.164	0.197	0.230	0.263	0.296	0.329	0.362	0.394	0.427	0.460	0.493	0.526	0.559	0.592
52.5	0.110	0.142	0.175	0.208	0.241	0.274	0.307	0.340	0.373	0.405	0.438	0.471	0.504	0.537	0.570	0.603
60	0.121	0.153	0.186	0.219	0.252	0.285	0.318	0.351	0.384	0.416	0.449	0.482	0.515	0.548	0.581	0.614
67.5	0.131	0.164	0.197	0.230	0.263	0.296	0.329	0.362	0.394	0.427	0.460	0.493	0.526	0.559	0.592	0.625
75	0.142	0.175	0.208	0.241	0.274	0.307	0.340	0.373	0.405	0.438	0.471	0.504	0.537	0.570	0.603	0.636
82.5	0.153	0.186	0.219	0.252	0.285	0.318	0.351	0.384	0.416	0.449	0.482	0.515	0.548	0.581	0.614	0.646
90	0.164	0.197	0.230	0.263	0.296	0.329	0.362	0.394	0.427	0.460	0.493	0.526	0.559	0.592	0.625	0.657

10-0000 SEWAGE AND SOLID WASTE DISPOSAL

TABLE 10.13

**WATER TEST TABLE
ALLOWABLE DROP IN 3" (75mm) STAND PIPE
PER 10 MINUTES
15" (375mm) DIAMETER**

\\LENGTH OF SPUR IN FEET, 4" DIAMETER																
	LENGTH OF MAIN LINE IN FEET – 15" DIAMETER															
	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
0	.13	.26	.40	.53	.67	.80	.94	1.07	1.20	1.34	1.47	1.61	1.74	1.88	2.01	2.14
25	.16	.29	.43	.56	.70	.83	.97	1.10	1.23	1.37	1.50	1.64	1.77	1.91	2.04	2.17
50	.26	.33	.47	.61	.83	.87	1.01	1.14	1.27	1.41	1.54	1.68	1.81	1.94	2.08	2.21
75	.30	.36	.50	.63	.77	.90	1.04	1.17	1.30	1.44	1.57	1.71	1.84	1.98	2.11	2.24
100	.33	.40	.54	.67	.81	.94	1.08	1.21	1.34	1.48	1.61	1.75	1.88	2.01	2.15	2.28
125	.37	.43	.57	.70	.84	.97	1.11	1.24	1.37	1.51	1.64	1.78	1.91	2.05	2.18	2.31
150	.41	.47	.61	.74	.88	1.01	1.15	1.28	1.41	1.55	1.68	1.82	1.95	2.08	2.22	2.35
175	.44	.51	.65	.78	.92	1.05	1.19	1.32	1.45	1.59	1.72	1.86	1.99	2.12	2.26	2.39
200	.48	.54	.68	.81	.95	1.08	1.22	1.35	1.48	1.62	1.75	1.89	2.02	2.16	2.29	2.42
225	.51	.58	.72	.85	.99	1.12	1.26	1.39	1.52	1.66	1.79	1.93	2.06	2.19	2.33	2.46
250	.55	.61	.75	.88	1.02	1.15	1.29	1.42	1.55	1.69	1.82	1.96	2.09	2.23	2.36	2.49
275	.58	.65	.79	.92	1.06	1.19	1.33	1.46	1.59	1.73	1.86	2.00	2.13	2.26	2.40	2.53
300	.62	.68	.82	.95	1.09	1.22	1.36	1.49	1.62	1.76	1.89	2.03	2.16	2.30	2.43	2.56

\\LENGTH OF SPUR IN METERS, 100mm DIAMETER																
	LENGTH OF MAIN LINE IN METERS – 375mm DIAMETER															
	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
0	0.041	0.082	0.123	0.164	0.205	0.247	0.288	0.329	0.370	0.411	0.452	0.493	0.534	0.575	0.616	0.657
7.5	0.052	0.093	0.134	0.175	0.216	0.257	0.299	0.340	0.381	0.422	0.463	0.504	0.545	0.586	0.627	0.668
15	0.063	0.104	0.145	0.186	0.227	0.268	0.310	0.351	0.392	0.433	0.474	0.515	0.556	0.597	0.638	0.679
22.5	0.074	0.115	0.156	0.197	0.238	0.279	0.321	0.362	0.403	0.444	0.485	0.526	0.567	0.608	0.649	0.690
30	0.085	0.126	0.167	0.208	0.249	0.290	0.331	0.373	0.414	0.455	0.496	0.537	0.578	0.619	0.660	0.701
37.5	0.096	0.137	0.178	0.219	0.260	0.301	0.342	0.384	0.425	0.466	0.507	0.548	0.589	0.630	0.671	0.712
45	0.107	0.148	0.189	0.230	0.271	0.312	0.353	0.394	0.436	0.477	0.518	0.559	0.600	0.641	0.682	0.723
52.5	0.118	0.159	0.200	0.241	0.282	0.323	0.364	0.405	0.447	0.488	0.529	0.570	0.611	0.652	0.693	0.734
60	0.129	0.170	0.211	0.252	0.293	0.334	0.375	0.416	0.457	0.499	0.540	0.581	0.622	0.663	0.704	0.745
67.5	0.140	0.181	0.222	0.263	0.304	0.345	0.386	0.427	0.468	0.510	0.551	0.592	0.633	0.674	0.715	0.756
75	0.151	0.192	0.233	0.274	0.315	0.356	0.397	0.438	0.479	0.520	0.562	0.603	0.644	0.685	0.726	0.767
82.5	0.162	0.203	0.244	0.285	0.326	0.367	0.408	0.449	0.490	0.531	0.573	0.614	0.655	0.696	0.737	0.778
90	0.173	0.214	0.255	0.296	0.337	0.378	0.419	0.460	0.501	0.542	0.583	0.625	0.666	0.707	0.748	0.789

10-0000 SEWAGE AND SOLID WASTE DISPOSAL

TABLE 10.14

**WATER TEST TABLE
ALLOWABLE DROP IN 3" (75mm) STAND PIPE
PER 10 MINUTES
18" (450mm) DIAMETER**

\\LENGTH OF SPUR IN FEET, 4" DIAMETER																
	LENGTH OF MAIN LINE IN FEET – 18" DIAMETER															
	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
0	.16	.32	.48	.64	.80	.96	1.12	1.28	1.45	1.61	1.77	1.93	2.09	2.25	2.45	2.57
25	.19	.35	.51	.67	.83	.99	1.15	1.31	1.48	1.64	1.80	1.96	2.12	2.28	2.48	2.60
50	.23	.39	.55	.71	.87	1.03	1.19	1.35	1.52	1.68	1.84	2.00	2.16	2.32	2.52	2.64
75	.26	.42	.58	.74	.90	1.06	1.22	1.38	1.55	1.71	1.87	2.03	2.19	2.35	2.55	2.67
100	.30	.46	.62	.78	.94	1.10	1.26	1.42	1.59	1.75	1.91	2.07	2.23	2.39	2.59	2.71
125	.33	.49	.64	.81	.97	1.13	1.29	1.45	1.62	1.78	1.94	2.10	2.26	2.42	2.62	2.74
150	.37	.53	.69	.85	1.01	1.17	1.33	1.49	1.66	1.82	1.98	2.14	2.30	2.46	2.66	2.78
175	.40	.56	.72	.88	1.04	1.20	1.36	1.52	1.69	1.85	2.01	2.17	2.33	2.49	2.69	2.81
200	.44	.60	.76	.92	1.08	1.24	1.40	1.56	1.73	1.89	2.05	2.21	2.37	2.53	2.73	2.85
225	.48	.64	.80	.96	1.12	1.28	1.44	1.60	1.77	1.93	2.09	2.25	2.41	2.57	2.77	2.89
250	.51	.67	.83	.99	1.15	1.31	1.47	1.63	1.80	1.96	2.12	2.28	2.44	2.60	2.80	2.92
275	.55	.71	.87	1.03	1.19	1.35	1.51	1.67	1.84	2.00	2.16	2.32	2.48	2.64	2.84	2.96
300	.58	.74	.90	1.06	1.22	1.38	1.54	1.70	1.87	2.03	2.19	2.35	2.51	2.67	2.87	2.99

\\LENGTH OF SPUR IN METERS, 100mm DIAMETER																
	LENGTH OF MAIN LINE IN METERS – 450mm DIAMETER															
	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
0	0.049	0.099	0.148	0.197	0.247	0.296	0.345	0.394	0.444	0.493	0.542	0.592	0.641	0.690	0.740	0.789
7.5	0.060	0.110	0.159	0.208	0.258	0.307	0.356	0.405	0.455	0.504	0.553	0.603	0.652	0.701	0.751	0.800
15	0.071	0.121	0.170	0.219	0.268	0.318	0.367	0.416	0.466	0.515	0.564	0.614	0.663	0.712	0.762	0.811
22.5	0.082	0.131	0.181	0.230	0.279	0.329	0.378	0.427	0.477	0.526	0.575	0.625	0.674	0.723	0.773	0.822
30	0.093	0.142	0.192	0.241	0.290	0.340	0.389	0.438	0.488	0.537	0.586	0.636	0.685	0.734	0.783	0.833
37.5	0.104	0.153	0.203	0.252	0.301	0.351	0.400	0.449	0.499	0.548	0.597	0.646	0.696	0.745	0.794	0.844
45	0.115	0.164	0.214	0.263	0.312	0.362	0.411	0.460	0.510	0.559	0.608	0.657	0.707	0.756	0.805	0.855
52.5	0.126	0.175	0.225	0.274	0.323	0.373	0.422	0.471	0.520	0.570	0.619	0.668	0.718	0.767	0.816	0.866
60	0.137	0.186	0.236	0.285	0.334	0.384	0.433	0.482	0.531	0.581	0.630	0.679	0.729	0.778	0.827	0.877
67.5	0.148	0.197	0.247	0.296	0.345	0.394	0.444	0.493	0.542	0.592	0.641	0.690	0.740	0.789	0.838	0.888
75	0.159	0.208	0.258	0.307	0.356	0.405	0.455	0.504	0.553	0.603	0.652	0.701	0.751	0.800	0.849	0.899
82.5	0.170	0.219	0.268	0.318	0.367	0.416	0.466	0.515	0.564	0.614	0.663	0.712	0.762	0.811	0.860	0.909
90	0.181	0.230	0.279	0.329	0.378	0.427	0.477	0.526	0.575	0.625	0.674	0.723	0.773	0.822	0.871	0.920

10-0000 SEWAGE AND SOLID WASTE DISPOSAL

TABLE 10.15

**WATER TEST TABLE
ALLOWABLE DROP IN 3" (75mm) STAND PIPE
PER 10 MINUTES
21" (525mm) DIAMETER**

\\LENGTH OF SPUR IN FEET, 4" DIAMETER																
	LENGTH OF MAIN LINE IN FEET – 21" DIAMETER															
	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
0	.18	.37	.56	.75	.94	1.12	1.31	1.50	1.69	1.88	2.06	2.25	2.44	2.63	2.82	3.00
25	.21	.40	.59	.78	.97	1.15	1.34	1.53	1.72	1.91	2.09	2.28	2.47	2.66	2.85	3.03
50	.25	.44	.63	.82	1.01	1.19	1.38	1.57	1.76	1.95	2.13	2.32	2.51	2.70	2.88	3.07
75	.28	.47	.66	.85	1.04	1.22	1.41	1.60	1.79	1.98	2.16	2.35	2.54	2.73	2.92	3.10
100	.32	.51	.70	.89	1.08	1.26	1.45	1.64	1.83	2.02	2.20	2.39	2.58	2.77	2.96	3.14
125	.35	.54	.73	.92	1.11	1.29	1.48	1.67	1.86	2.05	2.23	2.42	2.61	2.80	2.99	3.17
150	.39	.58	.77	.96	1.15	1.33	1.52	1.71	1.90	2.09	2.27	2.46	2.65	2.83	3.03	3.21
175	.43	.62	.81	1.00	1.19	1.37	1.56	1.75	1.91	2.13	2.31	2.50	2.69	2.88	3.07	3.25
200	.46	.65	.84	1.03	1.22	1.40	1.59	1.78	1.97	2.16	2.34	2.53	2.72	2.91	3.10	3.28
225	.50	.69	.88	1.07	1.26	1.44	1.63	1.82	2.01	2.20	2.38	2.57	2.76	2.95	3.14	3.32
250	.53	.72	.91	1.10	1.29	1.47	1.66	1.85	2.04	2.23	2.41	2.60	2.79	2.98	3.17	3.35
275	.57	.76	.95	1.14	1.33	1.51	1.70	1.89	2.08	2.27	2.45	2.64	2.83	2.92	3.21	3.39
300	.60	.79	.98	1.17	1.36	1.54	1.73	1.92	2.11	2.30	2.48	2.67	2.86	2.95	3.24	3.40

\\LENGTH OF SPUR IN METERS, 100mm DIAMETER																
	LENGTH OF MAIN LINE IN METERS – 525mm DIAMETER															
	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
0	0.058	0.115	0.173	0.230	0.288	0.345	0.403	0.460	0.518	0.575	0.633	0.690	0.748	0.805	0.863	0.920
7.5	0.068	0.126	0.184	0.241	0.299	0.356	0.414	0.471	0.529	0.586	0.644	0.701	0.759	0.816	0.874	0.931
15	0.079	0.137	0.194	0.252	0.310	0.367	0.425	0.482	0.540	0.597	0.655	0.712	0.770	0.827	0.885	0.942
22.5	0.090	0.148	0.205	0.263	0.321	0.378	0.436	0.493	0.551	0.608	0.666	0.723	0.781	0.838	0.896	0.953
30	0.101	0.159	0.216	0.274	0.331	0.389	0.447	0.504	0.562	0.619	0.677	0.734	0.792	0.849	0.907	0.964
37.5	0.112	0.170	0.227	0.285	0.342	0.400	0.457	0.515	0.573	0.630	0.688	0.745	0.803	0.860	0.918	0.975
45	0.123	0.181	0.238	0.296	0.353	0.411	0.468	0.526	0.583	0.641	0.699	0.756	0.814	0.871	0.929	0.986
52.5	0.134	0.192	0.249	0.307	0.364	0.422	0.479	0.537	0.594	0.652	0.709	0.767	0.825	0.882	0.940	0.997
60	0.145	0.203	0.260	0.318	0.375	0.433	0.490	0.548	0.605	0.663	0.720	0.778	0.836	0.893	0.951	1.008
67.5	0.156	0.214	0.271	0.329	0.386	0.444	0.501	0.559	0.616	0.674	0.731	0.789	0.846	0.904	0.962	1.019
75	0.167	0.225	0.282	0.340	0.397	0.455	0.512	0.570	0.627	0.685	0.742	0.800	0.857	0.915	0.972	1.030
82.5	0.178	0.236	0.293	0.351	0.408	0.466	0.523	0.581	0.638	0.696	0.753	0.811	0.868	0.926	0.983	1.041
90	0.189	0.247	0.304	0.362	0.419	0.477	0.534	0.592	0.649	0.707	0.764	0.822	0.879	0.937	0.994	1.052

10-0000 SEWAGE AND SOLID WASTE DISPOSAL

TABLE 10.16

**WATER TEST TABLE
ALLOWABLE DROP IN 3" (75mm) STAND PIPE
PER 10 MINUTES**

24" (600mm) DIAMETER

\\LENGTH OF SPUR IN FEET, 4" DIAMETER																
	LENGTH OF MAIN LINE IN FEET – 24" DIAMETER															
	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
0	.21	.42	.63	.85	1.07	1.28	1.50	1.71	1.93	2.14	2.36	2.57	2.79	3.00	3.22	3.43
25	.24	.45	.67	.88	1.10	1.31	1.53	1.74	1.96	2.17	2.39	2.60	2.82	3.03	3.25	3.46
50	.28	.49	.71	.92	1.14	1.35	1.57	1.78	2.00	2.21	2.43	2.64	2.86	3.07	3.29	3.50
75	.31	.52	.74	.95	1.17	1.38	1.60	1.81	2.03	2.24	2.46	2.67	2.89	3.10	3.32	3.53
100	.35	.56	.78	.99	1.21	1.42	1.64	1.85	2.07	2.28	2.50	2.71	2.93	3.14	3.36	3.57
125	.38	.59	.81	1.02	1.24	1.45	1.67	1.88	2.10	2.31	2.53	2.74	2.96	3.17	3.39	3.60
150	.42	.63	.85	1.06	1.28	1.49	1.71	1.92	2.14	2.35	2.57	2.78	3.00	3.21	3.43	3.64
175	.46	.67	.89	1.10	1.32	1.53	1.75	1.96	2.18	2.39	2.61	2.82	3.04	3.25	3.47	3.68
200	.49	.70	.92	1.13	1.35	1.55	1.78	1.99	2.21	2.42	2.64	2.85	3.07	3.28	3.50	3.71
225	.53	.74	.96	1.17	1.39	1.60	1.82	2.03	2.25	2.46	2.68	2.89	3.11	3.31	3.54	3.75
250	.56	.77	.99	1.20	1.42	1.63	1.85	2.06	2.28	2.49	2.71	2.92	3.14	3.35	3.57	3.78
275	.60	.81	1.03	1.24	1.46	1.67	1.89	2.10	2.32	2.53	2.75	2.96	3.18	3.39	3.61	3.82
300	.63	.84	1.06	1.27	1.49	1.70	1.92	2.13	2.35	2.56	2.78	2.99	3.21	3.42	3.64	3.85

\\LENGTH OF SPUR IN METERS, 100mm DIAMETER																
	LENGTH OF MAIN LINE IN METERS – 600mm DIAMETER															
	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
0	0.066	0.131	0.197	0.263	0.329	0.394	0.460	0.526	0.592	0.657	0.723	0.789	0.855	0.920	0.986	1.052
7.5	0.077	0.142	0.208	0.274	0.340	0.405	0.471	0.537	0.603	0.668	0.734	0.800	0.866	0.931	0.997	1.063
15	0.088	0.153	0.219	0.285	0.351	0.416	0.482	0.548	0.614	0.679	0.745	0.811	0.877	0.942	1.008	1.074
22.5	0.099	0.164	0.230	0.296	0.362	0.427	0.493	0.559	0.625	0.690	0.756	0.822	0.888	0.953	1.019	1.085
30	0.110	0.175	0.241	0.307	0.373	0.438	0.504	0.570	0.636	0.701	0.767	0.833	0.899	0.964	1.030	1.096
37.5	0.121	0.186	0.252	0.318	0.384	0.449	0.515	0.581	0.646	0.712	0.778	0.844	0.909	0.975	1.041	1.107
45	0.131	0.197	0.263	0.329	0.394	0.460	0.526	0.592	0.657	0.723	0.789	0.855	0.920	0.986	1.052	1.118
52.5	0.142	0.208	0.274	0.340	0.405	0.471	0.537	0.603	0.668	0.734	0.800	0.866	0.931	0.997	1.063	1.129
60	0.153	0.219	0.285	0.351	0.416	0.482	0.548	0.614	0.679	0.745	0.811	0.877	0.942	1.008	1.074	1.140
67.5	0.164	0.230	0.296	0.362	0.427	0.493	0.559	0.625	0.690	0.756	0.822	0.888	0.953	1.019	1.085	1.151
75	0.175	0.241	0.307	0.373	0.438	0.504	0.570	0.636	0.701	0.767	0.833	0.899	0.964	1.030	1.096	1.161
82.5	0.186	0.252	0.318	0.384	0.449	0.515	0.581	0.646	0.712	0.778	0.844	0.909	0.975	1.041	1.107	1.172
90	0.197	0.263	0.329	0.394	0.460	0.526	0.592	0.657	0.723	0.789	0.855	0.920	0.986	1.052	1.118	1.183

10-0000 SEWAGE AND SOLID WASTE DISPOSAL

10-0200 INDIVIDUAL SEWAGE (SEPTIC) DISPOSAL SYSTEMS

10-0201 (61-98-PFM) Design of individual sewage (septic) disposal system shall comply with Health Department requirements.

10-0300 SOLID WASTE AND RECYCLING SYSTEM (39-93-PFM) (65-99-PFM) (101-08-PFM)

10-0301 Applicability. The provisions of Chapter 109.1 (Solid Waste Management) of the Code of the County of Fairfax, VA related to collection, storage, recycling and disposal of solid waste apply to all residential and nonresidential properties. This requires that the developer of each project provide for solid waste and recycling systems (i.e., separation, storage and collection) and indicate on the plans how this is to be accomplished.

10-0302 References. The technical requirements for solid waste and recycling systems are contained in Chapter 109.1 of the Code of the County of Fairfax and the accompanying guidance document, "Recycling Program Requirements" incorporated into Chapter 109.1 by reference in accordance with Section 109.1-1-1.

Mixed Paper and Cardboard means flattened corrugated cardboard, magazines, catalogues, envelopes, office paper, brochures, phone books, junk mail, food boxes (such as cereal and cracker boxes), shoe boxes, and any other clean paper product without food residue.

Principal Recyclable Material (PRM) is the recyclable material that comprises the largest quantity by weight in the waste stream.

Recycling means the process of separating a material from the waste stream with the intent of diverting it from disposal as solid waste.

Recycling System is the means by which recyclable materials are separated from the waste stream at the point of generation, and may include the means of delivering source-separated materials to a recycling center or Materials Recovery Facility.

Solid Waste is any material defined as solid waste in 9 VAC 20-80-140 et seq. of Virginia's solid waste management regulations.

Source Separation is the process of removing recyclable materials from the waste stream at the point where the material is generated. For residential material, the source is considered the household and contiguous residential property such as lawns or yards. For commercial material, the source is considered the commercial premises in which business is conducted and contiguous property such as storage yards.

Waste Stream Quantity means the total weight of solid waste disposed plus the total weight of materials recycled from the waste stream. "*Combined waste stream quantity*" refers to the aggregate waste stream of all tenants and/or occupants of a business property or complex.

Yard Waste means the organic fraction of municipal solid waste that consists of grass clippings, leaves, and brush arising from general landscape maintenance. Yard waste also includes similar materials collected from nonresidential landscape maintenance, such as maintenance of streets, parks and recreational areas. Yard waste does not include any materials arising from tree removal, land clearing, or development activities.

10-0303 Recycling for Residential Properties (including condominiums and apartments).

10-0303.1 Occupants of single-family attached and detached dwelling units shall source-separate cans, bottles (plastic, metal and glass), yard waste, mixed paper and cardboard. No specific design requirements are applied to the design of such structures for trash and recycling.

10-0303.2 Owners of multifamily dwelling units holding a valid construction permit on or after July 1, 2007, shall provide a recycling system for their residents to source-separate cans, bottles (plastic, metal and glass), mixed paper and cardboard.

10-0304 Recycling for Nonresidential Properties (all uses not included in Sect. 303 above).

10-0304.1 Owners of nonresidential properties shall provide a recycling system for their tenants, occupants, employees, and vendors to recycle, at a minimum, the establishment's mixed paper and cardboard.

10-0000 SEWAGE AND SOLID WASTE DISPOSAL

10-0304.2 Owners of nonresidential properties that generate an annual total waste stream of 100 tons (90.72 metric tons) or more, or have an annual average occupancy of 200 persons or more, shall be required to provide a recycling system for the establishment's Principal Recyclable Material (PRM), in addition to mixed paper and cardboard. If a material from the list below is the PRM, it must be recycled in addition to mixed paper and cardboard: Ferrous scrap metal; Non-ferrous scrap metal; Used motor oil; Container glass; Aluminum or tin cans; Cloth; Automobile bodies; Plastic; Clean wood; Brush, leaves, grass, and other arboreal materials.

10-0304.3 Owners of nonresidential properties which generate mixed paper and cardboard as their PRM need only recycle those materials as determined by the Division of Solid Waste Collection and Recycling.

10-0305 Waste Stream Calculation Worksheet and Statement.

10-0305.1 The owner/developer of any multifamily or nonresidential property shall submit a Waste Stream Calculation Worksheet, on the standardized form provided by the Division of Solid Waste Collection and Recycling, DPWES prior to site plan approval. The worksheet shall include an estimate of the combined annual waste stream quantity for the project and describe the method(s) by which recyclable materials are to be separated from the waste stream. The purpose of estimating the quantity of trash and recycling is to ensure that adequate space is allocated to collect and store these materials.

10-0305.2 A statement shall be added on the cover sheet of all site plans specifying the type of development (multifamily, single-family or townhouse, nonresidential), materials being recycled and the location of the dedicated space for collection of trash and recyclables.

10-0306 Design Standards and Guidelines

10-0306.1 Project designers must designate on the site plan the location of the pad to accommodate trash and recycling. The designated pad must be constructed of a material that is able to withstand the proposed load (concrete is recommended). Areas 30 feet (9.1 meters) in front of the pads should also be

reinforced to withstand the weight of the collection vehicle. In instances when site constraints prohibit total concrete surfacing, a concrete service pad extending 13 feet (4.0 meters) in front of the enclosure shall be provided to withstand the pressure of the front wheels of the vehicle while dumping.

10-0306.2 Access to collection and storage areas must be by internal travelways and parking areas within a site. No collection device may be accessed directly from a public street, and no backing movement from an internal collection device may encroach into any street. Parking areas should allow for a circular through movement wherever possible to avoid back-up movements. Where a circular through movement is not possible, maneuvering space in front of any dumpster must be provided. Back-up and turnaround space must have a minimum width of 15 feet (4.6 meters) and a depth of 30 feet (9.1 meters).

10-0306.3 All collection and storage areas shall be designed to provide positive drainage, be accessible to collection equipment, public health inspectors, and County fire and solid waste inspection personnel. In addition, exterior storage containers and equipment shall comply with Chapters 62 (Fire Protection), 46 (Health or Safety Menaces), 109.1 (Solid Waste) and 112 (Zoning Ordinance) of the County Code.

10-0306.4 Containers shall not be placed in required transitional screening yards, tree save areas, designated open space area, floodplain or RPA. They shall not be located in any area where they will block sidewalks, trails, required parking spaces, loading spaces or be located within any street. Screening shall be provided in accordance with the Zoning Ordinance.

10-0306.5 Trash and recycling containers shall be placed adjacent to each other in the enclosure or in the same central storage area. The capacity for the trash and recycling containers and their storage areas must be adequate to accommodate the volume of materials as projected on the Waste Stream Calculation Worksheet with a frequency of collection not less than once per week.

10-0306.6 The designated pad for side by side dumpsters for collection and storage of trash and recyclable materials should be 22 feet (6.7 meters) wide X 10 feet (3.0 meters) in accordance with Plate

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33-10 (33M-10). Additional space to accommodate additional containers, compactor equipment and/or storage areas for cardboard bales and pallets shall be provided as needed. Alternative pad configurations may be approved by the Director in keeping with the purpose and intent of § 10-0300.

10-0306.7 Areas designated for trash and recycling containers for multi-family properties should generally be located within 200 feet (61.0 meters) walking distance of the building to be served unless otherwise approved by the Director.

10-0306.8 Minimum required vertical clearances for front-end loading vehicles collecting trash or recyclables stored in side by side dumpsters are 24 feet (7.1 meters) overhead and 10 feet (3 meters) width of clear opening.

10-0306.9 Required vertical clearances for safe access by roll-off trucks used to pull stationary compactor units and roll-off boxes at loading docks are 18 feet (5.5 meters) overhead for entry of the truck only, 24 feet (7.3 meters) when the truck hoist is raised with a rectangular box container and 11 feet (3.3 meters) width of clear opening. A minimum of 65 feet (19.8 meters) shall be provided for the safe unloading/loading of container.

10-0306.10 Required vertical clearance for safe access by rear-loading refuse -vehicles collecting trash or recyclables set out in roll-out carts, trash and recycling storage collection areas is 14 feet (4.3 meters) overhead and 10 feet (3 meters) width of clear opening.